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(54) Title: VIDEO SIGNAL GENERATION

(57) Abstract

The invention relates to the generation of a video display which is generated from a broadcast stream of digital data which is received from a remote transmitter. In the transmission system, data representing the first and second video diplays is scaled, combined and encoded at the transmitting location and then is transmitted in the encoded format. Data is received by a receiver which decodes the received data and generates first and second video displays in response to the first and second video display data received. In one embodiment the user of the receiver can then select whether the first and second displays are to be shown in conjunction or not. One display may be selected to show additional information to the viewer which relates to the other display and in one embodiment, one display may include visual signing information for the deaf and which visual signing information relates to the information being displayed on the other display.

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Video Signal Generation

The invention which is the subject of this application relates to the generation of video displays from a broadcast stream of information. The video display generated is displayed on a display means such as a television screen or monitor screen and generates a recognisable and defined display to be watched by the viewer. The invention is particularly directed towards the ability to generate a video signal and interpret the same to allow a plurality of displays to be displayed on the screen. It is submitted that this has several advantages, such as, but not exclusively, the generation of a display showing signing information for the deaf, with the signing information relating to the images and audio signals for another display shown; the showing of displays which indicate to the viewer what is being displayed on other channels and the like.

In general, the broadcast of television video signals whether it be by analogue or, increasingly, digital broadcast systems, involves the transmission of a number of streams of data representing the broadcast picture, said streams of data generated by encoding apparatus, to the decoding apparatus which is provided at each of the premises of subscribers to the broadcast service. Each channel which can be viewed is formed from a combination of video and audio data streams, each of which carries information relating to the video or audio signal to be generated. At the broadcast stage the video and audio signals are encoded into streams of data representative of portions or blocks of the display which is being broadcast and are encoded by splitting the display into a number of pixels the number of which define the resolution and data is generated to represent the pixel blocks defined. The encoding method used is a manner best suited to the particular display or audio requirements at that time so that the stream of data is accurate but is also as short as practically possible so as to improve

bandwidth efficiency. The signals can be broadcast via satellite, cable or using conventional transmitters and are received by the decoder. The decoder is required to decode the data streams and regenerate a picture which is to be displayed on the screen. There are various International Standards in position to which manufacturers of the required apparatus comply such as for example, MPEG 1 and MPEG 2 standards.

A known problem with this form of video signal transmission is that the requirement to selectively show a further display on screen as a smaller part of the larger display has not been addressed effectively. It is known to be possible to generate displays from a number of the streams of data and then display a number of subsidiary displays to form one overall display by using the technique of mosaicing but this type of display is only formed from a combination of side by side displays and is not satisfactory . This is not a solution to the problem addressed by the current invention wherein there may be a need for an additional display such as the service of a visual signing display to be provided by the broadcast providers so that the service can be selectively displayed by those viewers who require the same. If mosaicing, i.e the use of a number of displays from a stream of data was used for this the visual signing would either have to be permanently shown to all viewers or to none of the viewers, which is unacceptable.

The aim of the present invention is to provide a means whereby at least two video displays can be generated from the same video signal data stream and then a decision made as to whether one or both or all of the displays are to be positioned to be viewable by the viewer.

In a first aspect of the invention there is provided a broadcast system, said system comprising an encoder for generating a single stream of data representing a video display of a predetermined

resolution, transmitting means for transmitting the stream of data to be received by a data receiver including decoder means, said decoder means provided to decode the single stream of data and the receiver provided to reconstruct the video display to be viewed on a display screen connected thereto and characterised in that said stream of data includes data for at least a first and a second video displays and the display generated on the display screen can be selected in response to a user command or a predetermined control setting to comprise the first or second display or either of the first or second display with the other positioned therein.

Typically the second display is smaller in size than the first display and is superimposed or overlaid on the first display to be viewed. Preferably the said second display is positioned so as to be unobtrusive such as in one of the corners of the screen when viewed. Although it is envisaged that the generation of first and second displays has particular advantages the generation of yet further displays can be of advantage.

In one embodiment the second display which is generated includes visual signing information and relates to the images which are displayed on the first display at that time, and are in synchronisation therewith.

In a further aspect of the invention there is provided a method of generating first and second video displays on a display screen which can be selectively shown simultaneously, said method comprising the steps of scaling a first video field to a resolution which is less than the predetermined resolution of video signal to be displayed on the display screen, scaling a second video field with a resolution no greater than that which is the difference between the predetermined resolution and the resolution of the first video field, combining and encoding the data for the first and second displays and transmitting

the encoded data for the video signal to a decoder, as a single stream of data decoding the data stream to generate video displays for said first and second video displays and upsampling the said first display to generate the same into the required size to be displayed across the display screen.

Typically the predetermined resolution referred to is the horizontal resolution which can be any standard or combined resolution such as, in one embodiment, 720 pixels. With this resolution, the encoding of the first display with a horizontal resolution of 544 pixels is found to be particularly advantageous. It is also of advantage if both of the first and second display video data is aspect ratio adjusted or includes scale factors prior to display.

In one embodiment of the method, if the second display is not to be displayed on the screen, the said display is "positioned" with respect to the first display so that it does not overlie the same so that when the video signal display is upsampled, the second display is not viewable.

If the second video display is required to be viewed by the viewer then the second display is positioned with respect to the first display to overlie the same when displayed on the screen. In one embodiment the second video display is moved to the required position on the first display prior to the upsampling of the same or alternatively the first display is upsampled and the second display moved into position.

It is envisaged that the selection of whether or not the second display is shown can be made by either the setting of a characteristic of a control feature of the decoding apparatus to allow for long term selection or, alternatively by remote control or other selection means provided. Typically the decoder includes a process unit to

allow the decoder to position the second display with respect to the first display as required.

In a further aspect of the invention there is provided a method for generating a video display of a predetermined resolution on a display screen, said method comprising generating a video signal comprising a first set of data relating to a first partition of the display of a resolution less than the predetermined resolution and a second set of data representing at least a second partition of the display, said first and second sets of data, in combination, representing the predetermined resolution, data representing the first and second sets of data transmitted as a single stream of data and then upsampling at least the first set of data relating to the first partition of the display.

Thus the decoder receives a transmitted stream of data which relates to a video display of the predetermined resolution, however it also receives a signal indicating that the data is in two sets representing different displays and said first display therefore has lower resolution than the predetermined resolution and the remaining data represents the video signal for the difference and the decoder reconstructs the data into frames of the number of the predetermined resolution, representing the first and second displays, the decoder then upsamples the first set of frames for the first display to allow the display of the same across the whole of the display screen.

If the second display is to be viewed the second display is moved to be superimposed on the first display and upsampling then takes place.

In a further aspect of the invention there is provided a video signal representing a first video display of a predetermined frame size and

a second video signal representing a second video display and wherein in the generation of the first video display to be shown the second video display can be selectively superimposed on the first video display to allow both first and second displays to be shown.

This aspect has the advantage in that the resolution of the first display is as the predetermined resolution and that no upsampling is required to take place prior to the display of the first display.

In a further aspect of the invention there is provided a method of scaling and encoding video data for first and second video displays to be selectively shown simultaneously when decoded, said method comprising the steps of scaling a first video field to a resolution which is less than the predetermined resolution of video signal to be displayed on the display screen, scaling a second video field with a resolution no greater than that which is the difference between the predetermined resolution and the resolution of the first video field, combining and encoding data and transmitting the encoded data for the video signal as a single stream of data.

Specific embodiments of the invention will now be described with reference to the accompanying drawings wherein;

Figures 1A - 1G illustrate an embodiment of the invention.

Figures 2A – 2G illustrate a variation of the embodiment of Figure 1.

Referring firstly to Figures 1A – 1G, there is shown, for illustrative purposes first, primary and second, secondary displays 2,4 according to the invention. These displays are shown in a form which is not for on screen display but are shown prior to final processing. To reach the stage of Figure 1 the following steps are followed.

Prior to transmission of the video signals which represent the first and second displays a decision is made as to the resolution of the position of the first display of the entire picture with respect to the standard or predetermined horizontal resolution of the picture. The resolution which is set determines the size of the blocks into which the first display position is split and data generated therefor to be sent as part of a video stream. The higher the resolution, the smaller the size of each block which is sampled and represented by the data and the better defined is the subsequent displayed picture on the display screen. One standard resolution value is 720 pixels and for this invention the resolution for the first display 2 is set at a lower value, say 544 pixels. This means that the size of each of the blocks is larger than normal although is still sufficient so as to allow an acceptable viewable displayed picture to be generated. The selection of the lower resolution leaves room for additional data to be transmitted in the same stream of data and the decoding of the same to be supported by conventional decoding apparatus which will still interpret that it has received data relating to 720 pixels. The remaining 176 pixels of information relates to the second display 4, which is of significantly smaller size.

Once the first and second displays are scaled to the selected resolutions the data relating to the first and second displays is generated, and a combined frame 5 constructed, which data for the combined frame is then encoded as a stream of data transmitted to the decoder. The decoder decodes the data into macroblocks relating to said first or second displays and reconstructs the frame as shown in Figure 1D with the decoder having decoded information equivalent to a 720 pixel resolution. However it will be seen that the first display is of the "wrong size" for the display screen and is therefore required to be upsampled so that it has the effect of being a 720 horizontal pixel frame display and fills the

display screen 6 as shown in Figure 1E. The data includes an aspect ratio or scale factor so that when upsampled the picture displayed has the correct appearance to the viewer.

The decoder can be provided with a dedicated unit which is set either at regular intervals by say, a viewer using a remote control command or alternatively may be set permanently to determine what happens to the second display 4. In one embodiment as shown in Figure 1E the second display is separated from the first display 2 so that the viewer only sees the upsampled first display 2 on the display screen 6. Figures 1F and 1G illustrate an alternative wherein the second display 4 is selected and moved to overlie part of the first display, and then upsampled so that the first and second displays 2,4, are viewable on the screen 6 as shown in Figure 1G.. This is of particular advantage for those viewers who are hard of hearing and wish to view visual signing shown in the second display 4 which relates to the first display 2. Thus it will be appreciated that the provision of the second display 4 is possible using the existing decoder capabilities and without any impact on the encoding apparatus. While there will be some loss in the resolution of the first display the reduced resolution chosen has no significant effect to the viewer and is outweighed by the benefits to be obtained.

Figures 2A – 2G illustrate an embodiment that can in one use be an enhancement to the embodiment shown in Figures 1A-1G and uses the same reference numerals and whereby in addition to scaling the second display 12 to fit the residual picture area, spatial re-ordering of the picture data elements takes place. This re-ordering of pixel data can be adjusted to suit the decoder to ease reconstruction of the picture, to improve the allocation of picture resolution and/or ease the handling of differing second display sizes.

The Figures 2A-2G embodiment can also be used in its own right and shows that rather than splitting data for a picture resolution of say 720 pixels into two partitioned displays as with Figures 1A – 1G the first display data 10 is generated for a resolution of 720 pixels as shown in Figure 2A and second display data 12 is generated as additional information in excess of the normal frame size as shown in Figure 2B. The macroblocks representing this second display can then be scaled and spatially re-ordered and added to a downsampled first display 10 to construct a frame 14 as shown in Figure 2C. The frame is then encoded and a stream of data transmitted. The stream of data is then decoded and reconstructed as shown in Figure 2D. In one embodiment, only the first display 10 is upsampled and shown in screen 6 as shown in Figure 2E, or alternatively, the second display 12 is overlaid on the display 10, and upsampled to provide a combined display as shown in Figures 2F and 2G. This process allows efficient use of the available picture area and can also be sued to ease the operations required by the decoder to reconstruct the picture from the data received.

It should be appreciated that there are potential uses other than for visual signing and second, and if required third or more displays can be generated as herein described, said displays relating, for example, to what is being shown on channels other than that shown on the first display. This service would typically be selected by the viewer to see what alternative program choices are available and/or ascertain whether a program which they wish to watch has started on another channel or whether adverts have finished or the like. The display would therefore have the capability to provide a first display which is the program being watched at the time, and further display or displays which the user selects to generate by selecting the appropriate channel numbers. This causes the smaller displays to be generated which, although perhaps not of optimum picture

resolution for long term viewing, adequately show the viewer what is currently being shown on the other channels selected.

Thus it will be seen that the invention as herein described has several potential uses and advantages.

Claims

1. A broadcast system, said system comprising an encoder for generating a single stream of data representing a video display of a predetermined resolution, transmitting means for transmitting the stream of data to be received by a data receiver including a decoder means, said decoder means provided to decode the single stream of data and the receiver provided to reconstruct the video display to be viewed on a display screen connected thereto and characterised in that said stream of data includes data for at least a first and a second video display and the display generated on the display screen can be selected in response to a user command or a predetermined control setting to comprise the first or second display or either of the first or second display with the other display positioned therein.

2. A broadcast system according to claim 1, wherein the second display is smaller in size than the first display and is superimposed or overlayed on the first display to be viewed.

3. A broadcast system according to claim 2 wherein the second display is positioned at or adjacent to one of the corners of the display screen.

4 A broadcast system according to claim 2 wherein the overlaying of the second display includes the step of the spatial reordering of the components of the second display.

5. A broadcast system according to any of the preceding claims wherein the second display and at least one further display is generated to be viewed in conjunction with the first display.

6. A broadcast display system according to any of the preceding claims wherein the second display which is generated includes visual

signing information which is provided in relation and in synchronisation with the images displayed on the first display.

7. A method of generating first and second video displays on a display screen which can be selectively shown simultaneously, said method comprising the steps of scaling a first video field to a resolution which is less than the predetermined resolution of video signal to be displayed on the display screen, scaling a second video field with a resolution no greater than that which is the difference between the predetermined resolution and the resolution of the first video field, combining and encoding the data for the first and second displays and transmitting the encoded data for the video signal to a decoder, as a single stream of data, decoding the data stream to generate video displays for the said first and second video displays and upsampling the said first display to generate the same into the required size to be displayed across the display screen.

8. A method according to claim 7 wherein the predetermined resolution referred to is the horizontal resolution which can be any standard, or combined resolution.

9. A method according to claim 8 wherein the combined resolution in one embodiment is 720 pixels and the first display is encoded with a horizontal resolution of 544 pixels.

10. A method according to claim 7 wherein the first and second display video data includes aspect ratio adjustment and/or scale factor adjustment prior to display.

11. A method according to claim 7 wherein the selection is made in accordance with a predetermined control at the decoder whether to display on screen the first and/or second video displays.

12. A method according to claim 7 wherein the selection is made in accordance with a selection entered by the user of the apparatus.

13. A method according to claim 7 wherein if the second display is selected not to be displayed on the screen, the said display is positioned with respect to the first display so that it does not overlie the same such that when the video signal display is upsampled, the second display is not viewable on the display screen.

14. A method according to claim 7 wherein the second video display is selected to be viewed by the viewer and the second display is positioned with respect to the first display to overlie the same when displayed on the display screen.

15. A method according to claim 14 wherein the second video display is moved to the required position on the first display prior to the upsampling of the same or, alternatively the first display is upsampled and the second display moved into position thereafter.

16. A method according to claim 7 wherein, the method includes the step of spatially reordering the data components of one of the displays prior to transmitting the single stream of data.

17. A method for generation a video display of a predetermined resolution on a display screen, said method comprising generating a video signal comprising a first set of data relating to a first partition of the display of a resolution less than the predetermined resolution and a second set of data representing at least a second partition of the display, said first and second sets of data, in combination representing the predetermined resolution, data representing the first and second sets of data transmitted as a single stream of data and then upsampling at least the first set of data relating to the first partition of the display.

18. A video signal representing a first video display of a predetermined frame size and a second video signal representing a second video display and wherein in the generation of the first video display to be shown the second video display can be selectively superimposed on the first video display to allow both first and second displays to be shown.

19 A method of scaling and encoding video data for first and second video displays to be selectively shown simultaneously, said method comprising the steps of scaling a first video field to a resolution which is less than the predetermined resolution of video signal to be displayed on the display screen, scaling a second video field with a resolution no greater than that which is the difference between the predetermined resolution and the resolution of the first video field, combining and encoding data and transmitting the encoded data for the video signal as a single stream of data.

FIG. 1A

FIG. 1B

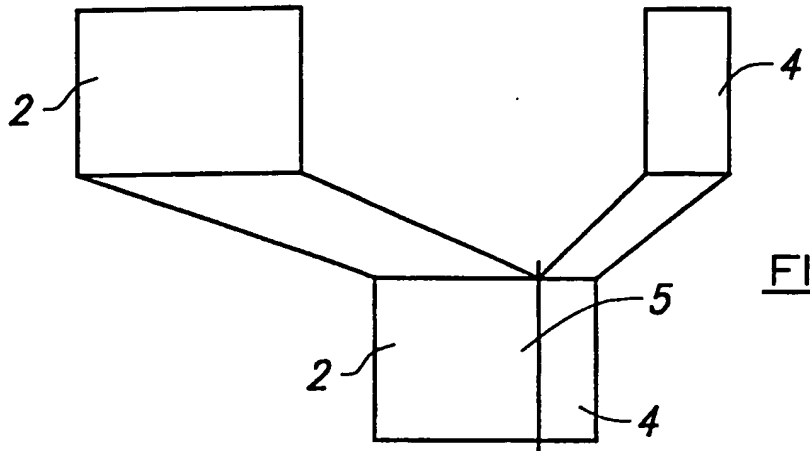

FIG. 1C

FIG. 1F

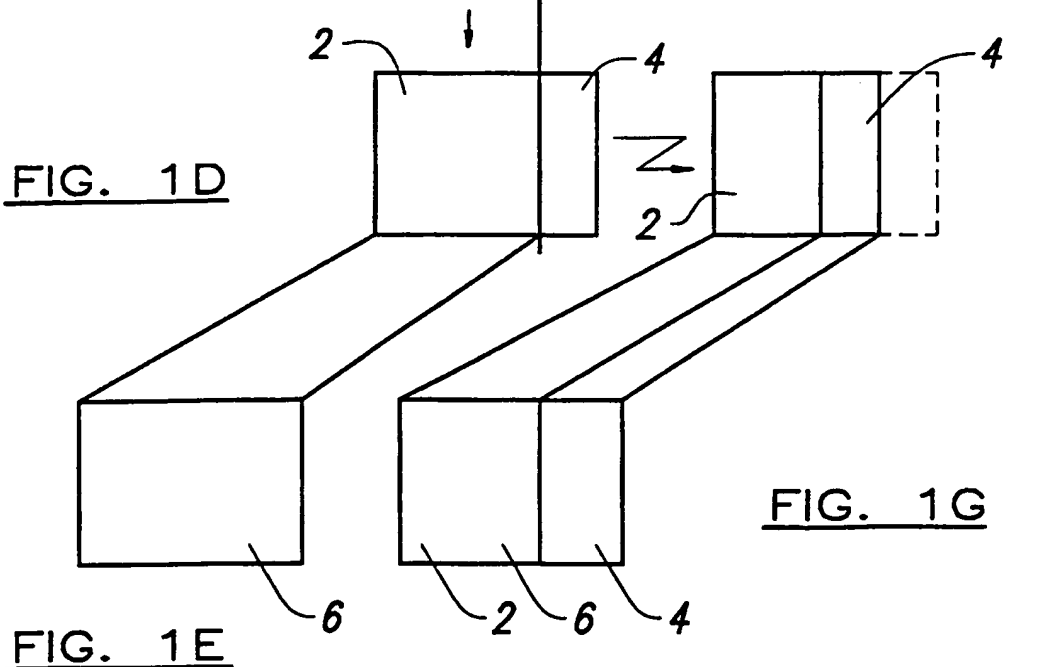

FIG. 1D

FIG. 1G

FIG. 1E

FIG. 2A

FIG. 2B

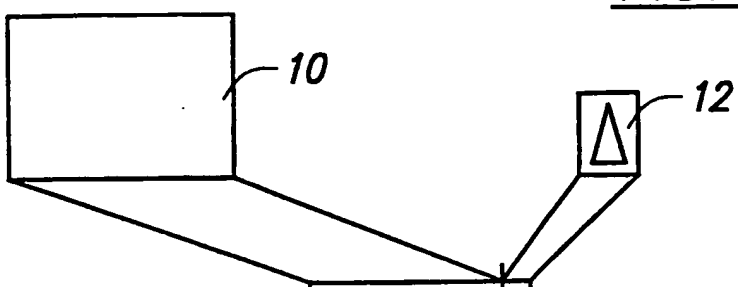

FIG. 2C

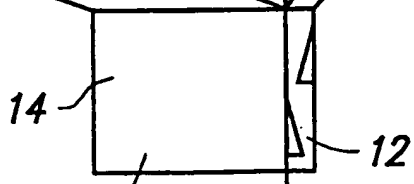

FIG. 2F

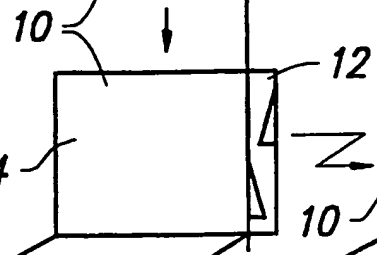

FIG. 2D

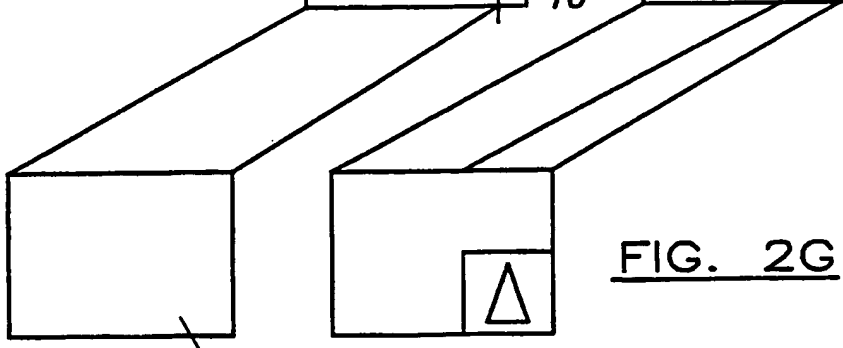

FIG. 2G

FIG. 2E

INTERNATIONAL SEARCH REPORT

Inte: onal Application No
PCT/GB 99/02421

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04N5/45

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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X	EP 0 661 888 A (MATSUSHITA ELECTRIC INDUSTRIAL CO. LTD.) 5 July 1995 (1995-07-05) the whole document ---	1,2,5,18
X	US 5 343 250 A (IWAMURA R.) 30 August 1994 (1994-08-30) column 1, line 39 -column 4, line 25 column 5, line 35 -column 10, line 6 --- -/--	1,5,7,8, 19

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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26 October 1999	03/11/1999

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1

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Inte onal Application No
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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1

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